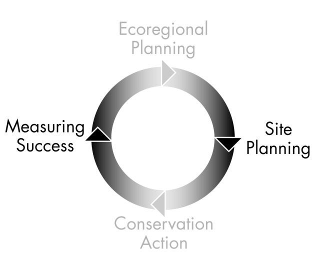
The Five-S Framework *for* Site Conservation

A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success



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The Nature Conservancy®
Saving the Last Great Places

The Five-S Framework for Site Conservation:

A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success

The mission of The Nature Conservancy is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

Front cover photographs (from left to right): Harold E. Malde, PhotoDisc, PhotoDisc, and Greg Miller/ TNC

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Preface

In 1997, The Nature Conservancy adopted *Conservation by Design: A Framework for Mission Success*, which established the Conservancy's long-term conservation goal and ecoregional approach for achieving the goal—the long-term survival of all viable native species and communities through the design and conservation of portfolios of sites within ecoregions. To implement this approach, the Conservancy has had to develop and apply more sophisticated methods for site-based conservation and for measuring progress towards our conservation goal.

Translating the ecoregional conservation approach as set forth in *Conservation by Design* into effective on-the-ground action encompasses four fundamental steps: ecoregional conservation planning, site conservation planning, taking conservation action, and measuring conservation success. The concepts, standards, and procedures for these steps (except taking action) are encapsulated in two practitioner's handbooks:

- *Designing a Geography of Hope: Guidelines for Ecoregion-Based Conservation in The Nature Conservancy* (March 2000, second edition) presents the methodology and guidelines for conservation planning at the ecoregional scale.
- *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success* (March 2000, first edition) sets forth a frame-work for site-based conservation, including strategic conservation planning and assessing measures of conservation success.

(*Note: Delivery mechanisms for taking conservation action are being assessed and developed.*)

To facilitate their use and to emphasize the pervasiveness of underlying conservation and planning concepts, the two handbooks overlap somewhat in the presentation of underlying concepts, and use terminology in a consistent fashion. Taken together, these handbooks provide the comprehensive rationale, standards, and procedures for implementing Conservation by Design.

This handbook is a short, how-to work-book. It is designed to serve as a stand-alone document—with brief explanations, fill-in-the-blank charts, and directions for determining conservation targets, analyzing threats, planning conservation strategies, and measuring success. It provides some contextual information, and references a *Supplemental SCP Volume* [in preparation] that contains more detailed explanations and descriptions of concepts, planning tools, and techniques.

The Nature Conservancy practiced land conservation for decades before developing and documenting the approach to site conservation presented in this handbook. Many times, we did smart things, either because they were obvious or because we had good intuition. Other times, we did things that were not very strategic in achieving biodiversity conservation results. In these latter instances, we misdirected our efforts or misspent our resources. The approach described in this handbook attempts to "unravel" the intuition that has led to sound conservation strategies at ecologically important places.

In addition, measuring the effectiveness of our conservation strategies and the progress toward achieving our conservation goals have played critical roles in directing the efforts of the staff to accomplish enduring, on-the-ground conservation results. For many years, the Conservancy's conservation goals and measures focused on acres acquired and dollars raised, and the organization traditionally assessed the performance of the various operating units according to these standards. *Conservation by Design* demands more sophisticated measures of conservation success than just "acres saved." This hand-book presents the set of conservation measures to meet that purpose.

Throughout the handbook you will encounter a series of "sidebars" covering key questions, tools, and useful hints. Each topic is set off from the main text and is introduced by a specific icon.

Key Questions. The key icon indicates key questions associated with each of the five S's that should be answered as part of site conservation planning.

Tools and Techniques. The hammer icon identifies specific planning tools, analytical techniques, and useful information that may be helpful in answering key questions or providing more in-depth analysis. The icon briefly introduces these tools, and refers the reader to appendices, the *Supplemental SCP Volume*, or other references for more detailed explanations.

Practical Tips and Hints. The lightbulb icon indicates a brief comment about a practical consideration of the current topic.

This is the first edition of the *Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*. You are encouraged to share your experiences, lessons learned, and best practices from applying the Five-S framework presented in this handbook so that the methodology and future editions of the handbook stay current and continue to be useful. Please contact the conservation ecologist or other appropriate support staff within your state, country, or divisional program, or the Site Conservation Program of the Conservation Science Division (site_conservation@tnc.org) with any questions, comments, suggestions, or experiences to share.

I. Introduction

Conservation by Design established the Conservancy's long-term conservation goal and ecoregional approach for achieving the goal—the long-term survival of all viable native species and communities through the design and conservation of portfolios of sites within eco-regions. Current and future ecoregional portfolios will include thousands of important conservation sites. For the near-term, the Conservancy's U.S. and International programs have established ambitious ten-year goals in pursuit of the long-term goal:

> *In 10 years, The Nature Conservancy and its partners will conserve 2500 sites identified by ecoregional plans in the United States—with special emphasis on 500 landscape-scale projects.*
>
> *Over the next 10 years, The Nature Conservancy and its partners will take direct action to conserve 100 landscape-scale projects in 35 countries, leveraging these investments to protect at least 500 additional sites in national portfolios.*

To achieve our ten-year goals, we will need to make strategic decisions regarding appropriate conservation actions at priority sites. We also must measure our progress towards these challenging goals. This *Practitioner's Handbook* provides a relatively simple, straightforward and proven process for developing conservation strategies and measuring the effects of those strategies, regardless of the spatial scale of the site or the type of biodiversity that is targeted for conservation. The process is known as site conservation planning. The conceptual framework and practicality of site conservation planning have been tested and refined through successful on-the-ground application of the process by experienced conservation practitioners.

The Framework, the Process, and the Plan

The Nature Conservancy initially developed the planning approach presented here for the "bioreserve" initiative, and called it the "Five S's": systems, stresses, sources, strategies, and success. Some people have added a sixth "S" (situation). Subsequently, the Five-S approach has been the basis for landscape-scale, community-based conservation workshops presented through the Center for Compatible Economic Development and Efroymson Fellowships. The Conservancy's Site Conservation Planning working group adapted it for the process known as site conservation planning. And most recently, it has become the foundation for the new measures of conservation success.

The Five-S approach to site conservation integrates the experience and knowledge gained through these various applications into a single, unified site-based framework. While the approach continues to focus on the original five S's for site conservation planning—*systems*, *stresses*, *sources*, *strategies*, and *success*—it has been updated to meet the demands of our more sophisticated approach to site conservation under Conservation by Design.

The Five-S approach to site conservation is the framework for the site conservation planning *process*. The Five-S framework is presented in more detail in Chapter III. The site conservation planning process assesses contextual information about a site (i.e., systems, stresses, sources) and results in two specific *products*—conservation strategies and measures of conservation success. The planning steps associated with each of the five S's are laid out in Chapters IV through VIII. Finally, the systems-stresses-sources assessment, the conservation strategies, and the measures of conservation success should all be documented in a site conservation plan. The standards for the site conservation planning process and for site conservation plans are set forth in Chapter II.

Conceptual Foundation

Three concepts are fundamentally important to understanding the logic and terminology of the Five-S approach to site conservation: scales of biodiversity and geography, functionality of conservation sites, and functional landscapes.

A more thorough description and discussion of these concepts than is provided in this handbook can be found in:

- Functional landscapes and the conservation of biodiversity, by Karen Poiani and Brian Richter. Working Papers in Conservation Science, No. 1. February 2000.

This working paper is available on the internet at http://consci.tnc.org/library/pubs/wpapers/WP1.PDF

- Biodiversity conservation at multiple scales, by Karen Poiani, Brian Richter, Mark Anderson, and Holly Richter. 2000. Bioscience. 50 (2). 133-146.

Scales of Biodiversity and Geography

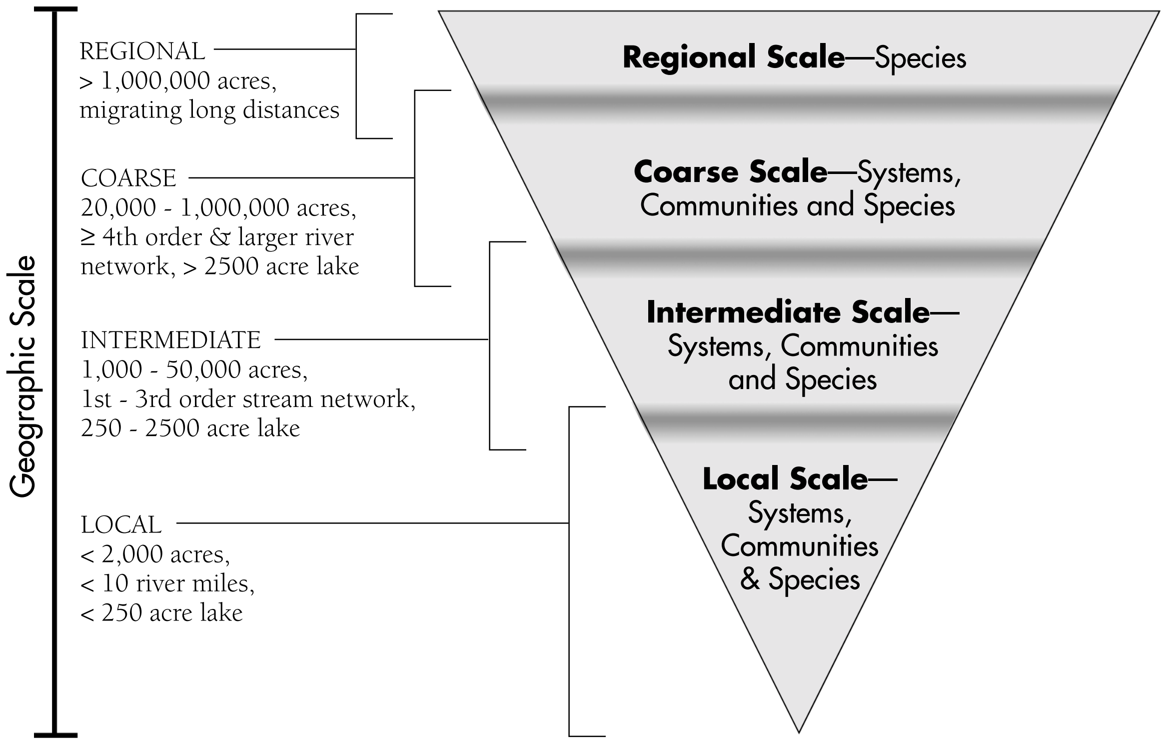
Two concepts of scale underlie the Five-S approach to site conservation: (1) level of biological organization, or biodiversity scale, and (2) geographic or spatial scale. To fully appreciate the logic and terminology of the Five-S frame-work for site conservation, it is necessary, to understand how biodiversity and spatial scale interact.

Scientists and conservation practitioners have long recognized that biodiversity exists at many levels of biological organization (i.e., genes, species, communities, ecosystems, and landscapes). In addition, biodiversity occurs at a variety of spatial or geographic scales (e.g., square feet to millions of acres; stream reach to stream/river networks). The levels of biological organization on which the Conservancy now focuses its conservation efforts—***species***, ***ecological communities***, ***ecological systems***[1,2]—can occur and function at various spatial scales. Figure 1 illustrates four geographic scales—***local***, ***intermediate***, ***coarse***, and ***regional***—at which species, ecological communities, and ecological systems occur, with each scale corresponding to a characteristic range in area or stream

[1] Levels of biodiversity organization are defined in Chapter IV (*Systems*).

[2] Throughout this handbook, the unmodified term "systems" represents the first "S" of the Five-S framework, and refers to the inclusive set of conservation targets (i.e., species, ecological communities, ecological systems) that are the focus of planning for a site. The term, when modified as "ecological systems," refers more specifically to conservation targets at the highest level of biodiversity organization, i.e., spatial assemblages of ecological communities (see Chapter IV).

Figure 1



length[3]. See Appendix B for a more in-depth description of levels of biological organization and corresponding spatial scales.

Site conservation planning primarily focuses on biodiversity at the coarse, intermediate, and local scales. Conservation of regional-scale species transcends individual sites and therefore must be addressed by networks of conservation sites, as described below. However, many specific attributes of regional-scale species occur at smaller geographic scales, such as the local-scale breeding aggregation of an anadromous salmon population, the intermediate-scale stopover area for migratory birds, or the coarse-scale migration corridor for wide-ranging ungulates. Although protection of these sites-specific attributes at a particular site is not sufficient to conserve a regional-scale species, such attributes are appropriately considered in site conservation planning. As discussed in Chapter IV (*Systems*), identifying the species, ecological communities, and ecological systems that are the conservation focus at a site (i.e., the conservation targets) is the first step in site conservation planning.

Site Functionality

Every conservation site where the Conservancy and our partners work has a set of conservation targets that represents and captures the biodiversity we seek to conserve. Our intention is to maintain

[3] Acreage and river miles/stream order are preliminary estimates and should be considered guidelines, not hard and fast boundaries.

the viability of the conservation targets over the long-term by maintaining the species, ecological communities, and ecological systems themselves and the ecological processes that sustain them. Site functionality is a measure of how well the site maintains the viability of the conservation targets.

Functional conservation sites have several characteristics. First, the size and configuration of the site are determined by the characteristics of the targeted species, ecological communities, and ecological systems, including the ecological processes that sustain them. Second, the fundamental ecological patterns and processes that maintain the targeted biodiversity must be within their natural (or acceptable) ranges of variation over a time frame relevant to conservation planning and management (e.g., 50-500 years). Third, human activity is not precluded from a functional conservation site, but functionality is likely to be greatly influenced by such activity. Finally, conservation sites may require ecological management and restoration, in addition to threat abatement, to maintain or enhance their functionality.

Presumably all conservation sites in an ecoregional portfolio are currently functional, or can have functionality restored through appropriate conservation action. In this respect, all sites in an ecoregional portfolio can be considered *functional conservation sites.*

Functional Landscapes

In site conservation planning, a particular set of functional conservation sites warrants special consideration—***functional landscapes***. Functional landscapes seek to conserve a large number of ecological systems, ecological communities, and species at coarse, intermediate, and local scales. In other words, the identified conservation targets at functional landscapes are intended to represent many other ecological systems, communities, and species, both known and unknown (i.e.,"all" biodiversity). Functional landscapes have a high degree of ecological intactness and retain (or can have restored) most or all of their key components, patterns, and processes. Functional landscapes, because they necessarily include coarse-scale conservation targets, are typically large in size.

The distinction between functional landscapes and other functional conservation sites, in practice, is not always clear cut because all ecological systems and ecological communities represent other elements of biodiversity to some extent (i.e., have a coarse-filter effect). Thus, the operational difference between functional landscapes and other functional conservation sites is the degree to which the conservation targets (1) are intended to represent other biodiversity, and (2) occur at coarse, intermediate, and local scales. If you deliberately define or select conservation targets to represent "all" biodiversity at the site and the targets occur at coarse, intermediate, and local scales, then the site is a functional landscape. If you have not deliberately identified targets to be representative in this way or if the targets are confined to only one or two spatial scales, then the site is not a functional landscape. This is so regardless of the coarse-filter characteristics of the identified targets or the geographic scale of the site. The challenges of selecting targets to represent "all" biodiversity and defining functionality for functional landscapes are discussed in Chapter IV (*Systems*).

Functional Networks of Conservation Sites

Site conservation planning focuses on the conservation of coarse-, intermediate-, and local-scale targets. Specific attributes of regional-scale species that occur at smaller geographic scales (e.g., breeding aggregation of a migratory bird or fish species) can also be addressed at individual conservation sites. However, successful conservation of regional-scale species requires a functional network of conservation sites. Regional-scale species and the key ecological processes that maintain them operate on a spatial scale that transcends individual conservation sites. Designing a functional network of sites for a regional species is part of the portfolio design process of ecoregional planning.

However, as mentioned above, regional-scale species are likely to have specific attributes operating at coarse, intermediate, or local scales that can and should be addressed through site conservation planning at individual sites. In such cases, the attributes themselves are considered conservation targets at the site. For example, a population of anadromous salmon may spawn and reproduce in one or two headwater streams, whereas the population utilizes spatially distant and distinct habitats as nursery areas, for migration to the ocean, and for marine life stages. For site conservation planning purposes, the breeding aggregation might be considered a conservation target for a site that encompasses the headwater stream system. The site would be functional for that specific life stage of the regional-scale species if the salmon were able to successfully spawn and reproduce. However, the site would not be considered functional for the population as a whole; a network of sites from headwater streams to the ocean would need to be conserved for the population to meet all its life history requirements.

Planning for Action

The Conservancy's ten-year conservation goals emphasize those conservation sites in ecoregional portfolios where the Conservancy will play a substantial conservation role—Conservancy "action sites."[4] It is these 2,500 domestic and 100 international conservation sites on which our site conservation planning efforts will be focused and over which our conservation success will be measured for the next ten years. The Conservancy's action sites will include functional landscapes as well as other functional conservation sites. Any particular action site may be geographically large or small depending on the characteristics and needs of the conser-vation targets that are the focus of conservation at the site.

The ten-year goals place special emphasis on the subset of "landscape-scale projects," or ***landscape action sites***. Landscape action sites are distinguished from other action sites by their large spatial scale and the need for a dedicated, full-time project director. Landscape action sites are geographically large—they are functional conservation sites (including, but not necessarily limited to functional landscapes) that have (1) coarse-scale conservation targets, or (2) intermediate- or local-scale targets with sustaining processes that operate at a coarse scale. The large geographic scale and the complex conservation situation that usually accompanies large size are what dictate the need for a full-time project director.

[4] "Action sites" include those sites formerly called "Phase I" sites, which were identified in advance of fully completed ecoregional plans, as well as those sites identified by ecoregional plans where the Conservancy will be substantially engaged over the next five to ten years. Ecoregional plans are asked to identify action sites based on biodiversity significance, threat, feasibility, and leverage.

II. Standards for Site Conservation Planning

The Five-S framework represents a set of guiding principles for making strategic conservation decisions and measuring conservation success at sites. The site conservation planning process can be adapted to meet the needs of local planning teams while maintaining the integrity of the guiding principles. Similarly, a site conservation plan should be designed and formatted to meet the needs and situation of the local conservation team.

While flexible, the site conservation planning process and site conservation plans must meet certain minimum standards:

Site conservation plans should be developed by interdisciplinary teams

Small teams typically are more effective than large teams, but local need should dictate team size. At a minimum, the team should include:

- One or more scientists who are knowledgeable about the site, conservation targets, and supporting natural processes.
- The local project director or other staff members who will be assuming responsibility for conserving the site and have knowledge of the local "situation" for conservation.
- The state conservation program director or the state/country program director.
- An experienced conservation practitioner who has demonstrated success at sites of similar character and complexity.

(*Note: The above criteria are not mutually exclusive.*)

Site conservation planning teams should deploy the Five-S methodology

- Assess and rank conservation targets (systems), stresses, and sources of stress.
- Develop strategies to abate threats and enhance the viability of conservation targets.
- Assess measures of conservation success—biodiversity health and threat abatement.

Site conservation planning teams periodically should review and update the plan, incorporating new knowledge, experience, and lessons learned

The thought process underlying the plan, shared among knowledgeable staff, is more important than a written document that sits on a shelf—so the plan should be kept current to maintain its usefulness.

There is no standard format for a site conservation plan. A plan should communicate the site-based information to the intended audience; the format, and type and amount of information may vary depending on the audience. At a minimum, site conservation plans should include a brief description of the systems, stresses, sources, and strategies; a map delineating the site and showing other relevant boundaries; and the status of Biodiversity Health and Threat Abatement measures of success. The description of the "S's" and measures can be simple (e.g., the Excel workbook, or the tables provided in Appendix A) and should emphasize the underlying logic and connection among them. Additional supporting information (e.g., ecological models and information, human context information, stakeholder analysis, implementation plan) can be included in the body of the plan or in appendices, as warranted.

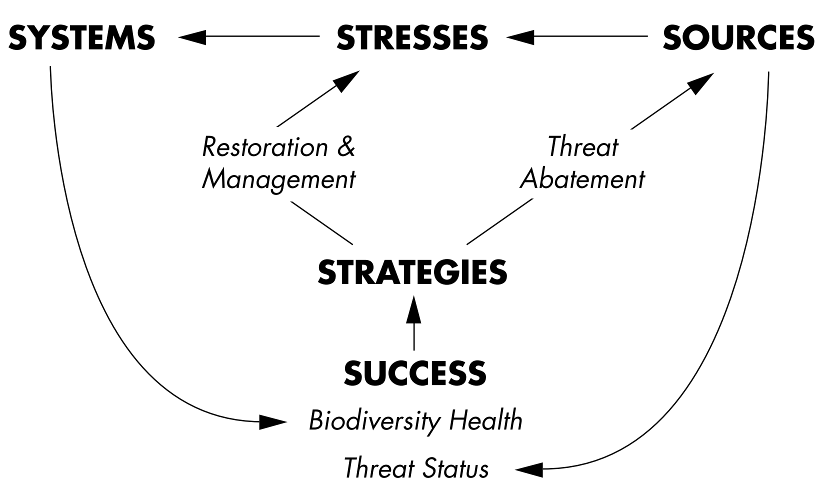
III. The "Five-S" Framework for Site Conservation Planning

The five S's include:

- **Systems:** the conservation targets occurring at a site, and the natural processes that maintain them, that will be the focus of site-based planning.
- **Stresses:** the types of degradation and impairment afflicting the system(s) at a site.
- **Sources:** the agents generating the stresses.
- **Strategies:** the types of conservation activi-ties deployed to abate sources of stress (threat abatement) and persistent stresses (restoration).
- **Success:** measures of biodiversity health and threat abatement at a site.

The logic underlying the Five-S framework is simple (Figure 2). Our implicit conservation goal at a site is to maintain viable occurrences of the conservation targets, i.e., maintain a functional site. By definition, viable occurrences are not significantly stressed. Therefore, the stresses must be abated to ensure viable conservation targets. Logically, there are two ways to lessen the stress and enhance or maintain the viability of the targets. The first is to abate the sources that are causing the stresses, under the assumption that the stress will subside if the source is removed. The second is to directly reduce the stresses that may persist once the source is removed. Thus, we develop and implement conservation strategies to (1) abate the critical sources of stress (i.e., threat abatement); and

Figure 2



(2) directly reduce persistent stresses (i.e., restoration). The measures of conservation success assess the effectiveness of our strategies at abating critical threats (Threat Status and Abatement measure) and the response in the viability of the conservation targets (Biodiversity Health measure), and provide the feedback for revising strategies, as warranted.

Two planning steps—defining conservation targets (systems) and critical threats (stresses and sources of stress)—are the vital foundation for developing sound strategies and measuring success. Chapters IV, V, and VI describe a proven, step-by-step approach for understanding and defining the conservation targets and critical threats at a site, and measuring biodiversity health and threat abatement.

A recommended approach for determining and prioritizing conservation strategies to abate critical threats and enhance or maintain systems is presented in Chapter VII.

Chapter VIII presents the foundation for the site-based measures of conservation success—Biodiversity Health and Threat Status—and provides the step-by-step method for assessing the conservation capacity indicators. (Note: the step-by-step approach for measuring Biodiversity Health and Threat Status are described in chapters IV [Systems], V [Stresses], and VI [Sources].) This chapter also presents a brief discussion of the inter-relationships between the measures of success, ecological monitoring, and adaptive management.

An automated Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* has been developed to assess systems, stresses, sources of stress, strategies, and to measure biodiversity health, threat abatement, and conservation capacity. The workbook is included on the diskette that accompanies this handbook, or is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). An analogous set of charts and instructions for completing these planning steps manually is provided in Appendix A (*A Step-by-Step Approach to Systems, Stresses, Sources, and Measures of Conservation Success*), Appendix D (*A Step-by-Step Approach to Developing Conservation Strategies*), and Appendix E (*A Step-by-Step Approach for Assessing Conservation Capacity*).

The automated workbook and manual worksheets are not intended to replace the good judgement of seasoned conservation professionals. They do, however, provide a clear pathway for evaluating systems, stresses, sources, and strategies, and for measuring biodiversity health, threat status, and conservation capacity. They can be useful even to the most seasoned practitioners, as a way of articulating the assumptions and testing the intuition of the site planning team.

Applications of the Five-S Framework

As with ecoregional conservation planning, four variables—*time, cost, quality,* and *scope*—constrain the site planning process. A planning team's decision regarding time, cost, quality, and scope will depend on several factors, including the level of analysis deemed useful or necessary, the amount of (ecological and human context) information available, the urgency of taking action, and the expected commitment of resources to the site by the Conservancy.

Often, when we first begin to work at a site, we lack a thorough understanding of the ecological systems and human context; thus, initial site conservation planning efforts are likely to be cursory, resulting in the identification of a limited set of preliminary or "no regret" strategies. Subsequent planning iterations will be based on additional information, new knowledge, and a better understanding of the human and ecological systems, resulting in a more thoughtful and perhaps broader set of conservation strategies.

The time taken to apply the Five-S framework can vary. A site planning team may develop a "rapid" site conservation plan in the course of a one- or two-day meeting; or it may meet several times over a period of weeks or months to develop a plan. Ideally, the thought process underlying the planning should be ongoing and shared among knowledgeable staff, leading over time to a more thorough understanding of the five "S's" and the conservation requirements at a site. Periodically, our strategic thinking should be consolidated and the plan updated to incorporate and document new knowledge, changing circumstances, and lessons learned.

Careful consideration of two guidelines will help ensure an efficient process and high quality product, regardless of the level of knowledge or time available:

1. Meet the site conservation planning standards set out in Chapter II.
2. Fully invest in the effort that will result in a useable but perhaps not "perfect" plan, and don't invest in the remaining, relatively large effort that may only marginally increase the usefulness of the plan.

Information Needs

Understanding the natural environment as well as the human context (situation) at a site underlies the application of the Five-S framework. Thus, two types of information are fundamental to the planning process, ecological information and human context information. Information about the ecological context of the conservation targets at a site underlies the assessment of systems, stresses, and biodiversity health. Information about the human context (i.e., land use and economic factors, laws and policies, cultural attitudes, constituencies and stakeholders) is essential for assessing sources of stress, developing effective conservation strategies, and measuring threat abatement. The local planning team will determine the level of information and expertise appropriate for a particular application of the Five-S framework. This decision will be made in the context of how much information, time, money, and other resources are available for the planning process, and the level of analysis deemed necessary or useful.

> The *Supplemental SCP Volume* provides detailed information on appropriate types of ecological and human context information to collect, and key sources of this information.

A Note on the Use of "Ranks" and Scores

In site conservation planning, the assessment of each "S" includes at least one step in which each item in a set of items is "ranked." We do not use the term "rank" in the sense of placing items in order relative to each other, i.e., highest to lowest, or greatest to least. Rather, we mean assigning each item to a particular class in an ordered classification—a common practice when different degrees of some phenomenon can be recognized. For example, the ordered classes we've identified for system viability are "Very Good", "Good", "Fair", and "Poor". The viability of some systems may be ranked (i.e., assigned to the class) "Very Good", others ranked "Good", and yet others ranked "Fair" or "Poor". Thus, the rank of a particular item designates the class to which it has been assigned.

Under certain circumstances a numerical score can be attached to each class[1], so that each item not only has a rank but also a score. The scores can then be added, multiplied, averaged, etc. We use numerical scores in assigning the biodiversity health measure of success.

A Note on Mapping and Site Delineation

Each of the five S's has a geographic aspect—where it occurs or where it is implemented can be located on a map. Locating particular systems, stresses, sources, and strategies is helpful for deploying conservation resources and taking conservation action at the appropriate places within the site. Subsequent chapters in this handbook briefly address mapping issues with the five S's, where appropriate. Collectively, the boundaries of the conservation targets and sustaining processes (i.e., ecological boundaries) delineate the functional conservation site—the area necessary to maintain the viability of the conservation targets over time, including the natural patterns and processes that sustain the targets. However, given that stresses, sources, and strategies also can be mapped, it is important that any mapped boundary be explicitly defined and labeled to avoid confusion.

[1] Assigning scores is appropriate when (1) the phenomenon in question could be measured on a continuous scale if we had measuring instruments that were accurate enough, and (2) the ordered classification can be regarded as an attempt to approximate the continuous scale with a cruder scale that is the best we can do in the present state of knowledge.

IV. Systems

Site conservation begins with understanding the conservation targets, including the natural processes that maintain them, that will be the focus for site conservation planning and measuring conservation success. Identification of focal conservation targets is the basis for all subsequent steps in site planning, including identifying threats, developing strategies, measuring success, and delineating the site boundary—a different set of targets is likely to result in different threats, strategies, measures of success, and site boundaries.

Ecoregional plans identify portfolios of sites within ecoregions. Each priority site in a portfolio has one or more *prima facie* reasons it has been selected for conservation—occurrences of important species, ecological communities, and ecological systems. These species, ecological communities, and ecological systems are referred to as conservation targets. Once engaged at a site, you will often identify or find it necessary to define other important species, communities, or ecological systems in addition to those identified through ecoregional planning. Ultimately, you must select or define a subset of all possible targets that will be the focus of the site planning process.

This chapter describes four steps for identifying focal conservation targets, characterizing the viability of these targets, and determining Biodiversity Health of the site:

1. Identify the focal conservation targets for site planning and measuring success
2. Determine the characteristics of viable conservation targets
3. Rank the focal conservation targets for viability
4. Determine "Biodiversity Health" of the site.

The first two steps are prerequisites for moving on to the next "S"—stresses (Chapter V)—and for measuring biodiversity health of the site. The third and fourth steps are specific to measuring biodiversity health.

Background

As outlined in Geography of Hope and subsequent publications, conservation targets may include the following:

- ***Ecological communities.*** Ecological com-munities are groupings of co-occurring species, as defined at the finest operational level of a community classification hierarchy, e.g., the "association" level of the Conservancy's U.S. National Vegetation Classification and the "alliance" level of the Conservancy's Aquatic Community Classification.

- ***Spatial assemblages of ecological communities, or "ecological systems".*** Ecological communities may be aggregated into dynamic assemblages or complexes that (1) occur together on the landscape; (2) are linked by ecological processes, underlying environmental features (e.g., soils, geology, topography), or environmental gradients (e.g., elevation, precipitation, temperature); and (3) form a robust, cohesive, and distinguishable unit on the ground. Ecological systems can be terrestrial, freshwater aquatic, marine, or some combination. See Appendix B for examples.

- ***Species.*** Types of species targets include:
    - **Imperiled and endangered native species**, including species ranked G1-G3 by Natural Heritage programs, federally listed or proposed for listing as Threatened or Endangered (U.S.), and on the IUCN Red List (international).
    - **Species of special concern** due to vulner-ability, declining trends, disjunct distributions, or endemic status within the ecoregion.
    - **Focal species**, including keystone spe-cies, wide-ranging (regional) species, and umbrella species.
    - **Major groupings of species** that share common natural processes or have similar conservation requirements (e.g., freshwater mussels, forest-interior birds).
    - **Globally significant examples of species aggregations**. An example is a migratory shorebird aggregation.

The purpose of conservation targets differs between ecoregional planning and site conservation planning. In ecoregional planning, the primary purpose of conservation targets is to guide site selection—ensure all biodiversity in the ecoregion is adequately represented in the ecoregional portfolio of conservation sites. In one sense, this is an accounting exercise, and the conservation targets are the currency. The tendency is to develop a comprehensive list of conservation targets known to occur within an ecoregion, and then select sites to adequately represent high quality or restorable occurrences of the targets. Also, to encourage consistency among sites and ecoregions, typically the targets are defined in the context of formal taxonomic and community classifications.

In contrast, the primary purpose of conservation targets in site planning is to guide conservation strategies at individual sites—what critical threats and persistent stresses must be abated in order to maintain or enhance the viability of the conservation target occurrences? The list of focal conservation targets for site planning need not be long and comprehensive; rather, it should be short and indicative of threats to and viability of the biodiversity of interest at a site. The conservation targets that occur at a site, as identified through ecoregional planning or otherwise, may be too numerous to individually assess during site conservation planning. Practical experience suggests that there should be no more than eight focal targets for any given site. It is important that these focal targets represent and capture all ecoregional conservation targets at the site, as well as all relevant levels of biodiversity organization and spatial scales. At functional land-scapes, the focal conservation targets are expected to subsume "all" biodiversity at the site. Focal conservation targets for site planning are often defined ad hoc by the site team rather than from formal classification systems, and thus may be idiosyncratic to the site.

A. *Identify the Focal Conservation Targets for Site Planning and Measures*

The first key question to address is

> ***What conservation targets will be the focus for site planning?*** ?

When identifying focal conservation targets for site conservation planning, the list of conservation targets developed through ecoregional planning is a good starting point. However, this list must be translated into no more than eight focal targets that adequately represent levels of biodiversity organization, spatial scale, and ecoregional planning targets. This is an extremely challenging task, especially for functional landscapes—it may be the most difficult step in the site conservation planning process.

Also, you and your site planning team must decide whether or not the site is or should be considered a functional landscape. Irrespective of how comprehensive or cursory the ecoregional targets, does the potential exist to conserve "all" biodiversity at the site, i.e., species, communities, and ecological systems at multiple spatial scales? The answer to this question will influence how you apply the next step.

There are four steps in identifying focal conservation targets:

STEP 1. Define the ecological systems and species groups (coarse, intermediate, and local scale, as appropriate) that occur at the site.

Ecological systems and species groups provide the broadest ecological context within which to conserve ecological communities and species. Some ecological systems and species groups that occur at the site may already have been identified during ecoregional planning; others may have to be defined *de novo* by you and your site planning team. The ecological systems and species groups identified in this step may be considered focal conservation targets.

There are two fundamental approaches to defining the ecological systems and species groups at a site. The *top-down* approach begins with a holistic ecological vision of the site, and breaks the whole into its component ecological systems. This approach is especially useful for functional landscapes, i.e., when the implicit conservation target is "all" biodiversity at multiple spatial scales and biological levels. The *bottom-up* approach builds the ecological systems and species groups by grouping ecologically related communities and species. The top-down and bottom-up approaches are not mutually exclusive, and may be most effective when utilized together.

1a. Identify all ecological systems that characterize the terrestrial, aquatic, and marine components of the site, as appropriate (i.e., top-down approach). Using the major components as an organizing framework, iden-tify all the major ecological systems occurring at the site. It is important to identify ecological systems at all appropriate spatial scales—local, intermediate, and coarse (see examples in Appendix B). In particular, coarse-scale ecolo-gical systems should be recognized because they provide the broadest ecological context within which to conserve intermediate- and local-scale communities and species.

Examples:

- The Laguna Madre landscape in Texas might be divided into six major ecological systems—coastal Texas sand plain, Tamaulipan thornscrub, freshwater wetlands and potholes, hypersaline lagoon system, barrier island com-plex, and nearshore marine system.
- The Canaan Valley/Dolly Sods site in West Virginia might be divided into six major systems—coarse-scale sub-alpine conifer matrix forest and northern hardwood matrix forest; intermediate-scale acidic wetlands and large, low-gradient, high elevation river system; and local-scale grass balds/heath barrens and circumneutral wetlands.

1b. Consolidate individual species and ecological communities into major groupings and ecological systems, respectively (i.e., bottom-up approach). At sites where numerous species and ecological communities have been identified either through ecoregional planning or subsequently by the site team, combine ecological communities or species that share a common set of sustaining ecological processes or conservation requirements into an ecological system or species group. It is important to define ecological systems and species groups at appropriate spatial scales—fine, intermediate, and coarse. These ecological systems and species groups may be considered focal conservation targets.

Examples:

- An intermediate-scale "freshwater mussels" grouping might be defined on the basis of common habitat requirements and fish hosts for a set of mussel species.
- At a riverine site in the Southeastern U.S., the stream (aquatic) system and the dynamic mosaic of floodplain plant community types, all created and maintained by the same fluvial processes, might be combined into a "ground-water-fed, blackwater stream–bottomland hard-wood forest" complex.
- A "shrub-steppe matrix" ecological sys-tem might consist of an assemblage of big sagebrush and bunchgrass communities, including the associated rare and common species that are dependent on this habitat.
- "Northern mesic conifer-hardwood forest," a composite of numerous forested communities that are (or were) widespread in the upper Midwest of the United States, might be identified as a conservation target at sites in that region.

STEP 2. Identify specific ecological communities, species, or species groups that occur at the site and have ecological attributes or conservation requirements not adequately captured within the previously defined ecological systems.

Types of ecological communities, species, and species groups to consider include:

2a. Individual species or species groups that disperse, travel, or otherwise use resources across different ecological systems. Such species help ensure attention to linkages, connectivity, ecotones, and environmental gradients.

Examples:

- In the Laguna Madre landscape in Texas, the ocelot is a focal target because it utilizes a suite of terrestrial-estuarine-barrier island-marine systems.

- A salamander species that moves from ponds for feeding to uplands for breeding and nesting might be recognized as a focal target.

2b. Important attributes of regional-scale species (or species groups) that should be conserved at this site. Individual conservation sites make important and often unique contributions to the functional network of sites that supports a population of a regional-scale species. The particular life stage(s) of the regional-scale species that is fulfilled at the site may be considered a focal conservation target.

Examples:

- Neotropical migratory bird species might be consolidated into a "Migrating Neotropical birds" grouping based on their common use of autumn staging habitat at a site along the Atlantic flyway. The focal target is the migratory life stage of the birds as they utilize the site.
- A functional landscape in the Pacific Northwest may contain the very best spawning streams in the ecoregion for a population of salmon. The reproductive life-stage of the salmon population could be considered a focal conservation target at this site.

2c. Individual species and ecological communities that have special conservation or management requirements. Individual ecological communities and species that require particular conditions that are different from the conditions required by broader species groups and ecological communities, or ecological systems, and that will not be adequately represented and captured by the focal targets identified in the previous steps, may be considered focal conservation targets. Some species need special attention not because they have special require-ments, per se, but because they are rare or imperiled.

Examples:

- A rare mussel species with a unique fish host or specialized habitat might be split out from the freshwater mussels grouping.
- A rare warbler with specialized staging habitat might be split out from the neotropical migrants grouping.
- Seagrass beds may need to be explicitly distinguished within the Laguna Madre hypersaline lagoon system because of their critical role in supporting the entire estuarine food web and their sensitivity to changes in water quality.

STEP 3. Of the conservation targets identified through the first two steps, identify the eight that best meet the following three criteria:

- ***Reflect ecoregion conservation goals.*** Focal targets that are grounded in the reasons for the site's inclusion in the ecoregional portfolio are more desirable. (If the ecoregional plan has not been completed, or if the first iteration of the ecoregional plan did not set goals for an important group of targets, e.g., aquatics, then the ecoregional importance of the target should be considered in light of the best available information).
- ***Represent the biodiversity at the site.*** The focal targets should represent or capture the array of ecological systems, communities and species at the site, and the multiple spatial

scales (coarse, intermediate, and local) at which they occur. A target that complements other focal targets in this respect is more desirable. This is especially important at functional landscapes, but also true at other functional sites.

- ***Are highly threatened.*** All else being equal, focusing on highly threatened targets will help ensure that critical threats are identified and addressed through conservation action.

STEP 4. Check the list of focal conservation targets to ensure that all conservation targets identified through ecoregional planning are adequately represented, and revise the site list as necessary.

Each conservation target identified through ecoregional planning should be explicitly attributed to one or more of the focal conservation targets for site conservation planning. These relationships should be documented (tables for documenting these relationships are provided in the *Site Conservation/Measures of Conservation Success* Excel workbook and in Appendix B). Any gaps, in this regard, should be acknowledged and addressed if possible. Any additions, deletions, or other revisions made to the ecoregional target list during site planning must be communicated back to the ecoregional planning team. New conservation targets and occurrences then can be considered during the next iteration of ecoregional planning.

Eglin Air Force Base and surrounding public and private lands—a functional landscape in the Florida panhandle where the Conservancy works with the Department of Defense and other partners—provides a good example of selecting focal conservation targets to reflect ecoregional goals, the array of communities and species at the site, and the linkages among ecological systems. As a functional landscape, the implicit conservation target is the set of "all" species, communities, and ecological systems within the Greater Eglin landscape. Four ecological systems and four species were selected as focal conservation targets: longleaf pine sandhill forest and longleaf pine-mixed hardwood forest (the two dominant, coarse-scale matrix forest types); seepage stream/slope forest complex (including seven ecological communities and 35 G1-G3 plants and animals); pitcher plant bogs-sandhill ponds; red-cockaded woodpecker; flatwoods salamander; Florida black bear; and Florida bog frog. All of these targets contribute to the conservation goals of the East Gulf Coastal Plain Ecoregion. Collectively, these focal targets cover coarse to local scales (see Appendix B), and are thought to represent the array of terrestrial and aquatic systems, communities, and species within the landscape, as well as the patterns and processes necessary to sustain them.

In some cases, the assessment of systems, stresses, sources, and strategies at a functional landscape may lead a site planning team to subdivide the large site into multiple, smaller sites for planning, implementation, and measuring success.

Returning to the Greater Eglin Air Force Base example, after further consideration of targets, threats, and potential conservation strategies, the planning team divided the single functional land-scape into three spatially-distinct, but adjacent functional landscapes: East Eglin, West Eglin, and Blackwater River State Forest (including associated private lands). Although the conservation targets were similar at these sites, the viability of the target occurrences, the types and degree of threats, and the conservation strategies were quite different. In this case, developing and implementing strategies and measuring success made more sense for the three individual sites than for the one composite site.

▶ The primary reason for subsuming individual species and communities into ecological systems or for identifying them individually apart from ecological systems is related to the identification of threats and strategies and the assessment of viability. If assessing two targets individually will lead to the identification of different threats and/or conservation strategies, or if the two targets are so different ecologically that they cannot (or should not) be combined for purposes of assessing viability, then it makes sense to distinguish them as separate targets. On the other hand, if the conservation requirements (i.e., threats, strategies) for one target subsume those of another target, it makes sense to combine the two.

▶ The viability of the focal conservation targets is the basis for the Biodiversity Health measure of success (see Step 2, below). Therefore the viability of each focal target must be measurable, either directly or via a set of indicators.

▶ **The identification or selection of focal conservation targets is an iterative process.** You will continue to re-evaluate and revise the focal conservation targets over the short term as you proceed through the site planning process (i.e., stresses, sources, strategies), and over the long term as you learn more about the ecological patterns and processes at the site and what threatens them. In addition, the focal conservation targets may change over time as strategies are implemented and threats are abated, or if the conservation situation changes significantly.

Appendix B illustrates the different levels of biodiversity organization and spatial scale, and provides illustrative examples of the focal conservation targets for several conservation sites.

For additional information about the treatment of conservation targets, see the following publications:

▶ *Designing a Geography of Hope,* 2nd Edition.

▶ *Setting Conservation Goals for Ecological Communities*, available upon request from the Conservation Planning program of the Conservation Science Division (contact Craig Groves, cgroves@tnc.org).

▶ Biodiversity conservation at multiple scales, by Karen Poiani, Brian Richter, Mark Anderson, and Holly Richter. 2000. Bioscience 50 (2). 133-146.

B. *DETERMINE THE CHARACTERISTICS OF VIABLE CONSERVATION TARGETS*

The continued existence of the focal conservation targets at the site will depend upon maintaining the natural processes that allowed them to establish and thrive in the past.

What factors, including key ecological processes, must be maintained to ensure the long-term viability of theconservation targets?

Three factors—***size***, ***condition***, and ***landscape context***—should be considered in characterizing viable occurrences of the focal conservation targets.

- ***Size*** is a measure of the area or abundance of the conservation target's occurrence. For ecological systems and communities, size may simply be a measure of the occurrence's patch size or geographic coverage. For animal and plant species, size takes into account the area of occupancy and number of individuals. Minimum dynamic area, or the area needed to ensure survival or re-establishment of a target after natural disturbance, is another aspect of size.
- ***Condition*** is an integrated measure of the composition, structure, and biotic interactions

that characterize the occurrence. This includes factors such as *reproduction*, *age structure*, *biological composition* (e.g., presence of native versus exotic species; presence of characteristic patch types for ecological systems), *physical and spatial structure* (e.g., canopy, understory, and groundcover in a forested community; spatial distribution and juxtaposition of patch types or seral stages in an ecological system), and *biotic interactions that directly involve the target* (e.g., competition, predation, and disease).

- ***Landscape context*** is an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the target occurrence, and connectivity. *Dominant environmental regimes and processes* include hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbance. *Connectivity* includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of any target to respond to environmental change through dispersal, migration, or re-colonization.

Characterizing the size, condition, and landscape context of a viable occurrence provides the basis for assessing stresses—the destruction, degradation, or impairment—that afflict the priority targets, as described in the next chapter. It also aids in the development of conservation goals (see next toolbox) and restoration strategies.

Two tools, conservation goals and conceptual ecological models, may provide clarity and focus in characterizing the viability of focal conservation targets.

- ***Conservation Goals*** are explicit descriptions of the *intended* viability status of a target—a goal specifies the characteristics for a viable occurrence. Goals ought to address size, condition, and landscape context. They may be broadly stated in terms of intended EO rank (i.e., an "A," "B," or "C") or Biodiversity Health category (i.e., "Very Good," "Good," or "Fair"), or may be stated more precisely in terms of specific size, condition, and landscape context characteristics. A more detailed discussion of conservation goals is provided in the *Supplemental SCP Volume*.
- ***Ecological Models*** describe our understanding of the relationships between and among the patterns of biodiversity (i.e., where conservation targets occur on the landscape) and the natural processes that create and maintain the patterns. Models are especially useful for summarizing the patterns and processes that characterize a target; identifying the viability of, and stresses to, the target; and identifying species and system components to monitor (i.e., attributes that reflect size, condition, and landscape context). A more detailed presentation on ecological models, including some examples, is provided in the *Supplemental SCP Volume*.

A note on boundaries related to conservation targets: The **pattern** of conservation target occurrences on the landscape and the natural **processes** that sustain the targets can be mapped. Boundaries depicting the patterns and sustaining processes of the conservation targets fall in to the category of ecological boundaries. Collectively, the relevant ecological boundaries delineate the *functional conservation site*. Additional information on site-based boundaries can be found in the *Supplemental SCP Volume*.

Note: Completing these first two steps for systems is a prerequisite for assessing stresses (Chapter V) and for measuring the biodiversity health of a site. The final two steps are specific to assessing biodiversity health (Steps C and D, below). We strongly recommend that you complete Steps 3 and 4 before assessing stresses.

C. *RANK THE FOCAL CONSERVATION TARGETS FOR VIABILITY*

The viability of a focal conservation target is a function of the size, condition, and landscape context of the target occurrence, as described above. Based upon the best available knowledge and judgement, rank the size, the condition, and the landscape context of each focal target. Each of the three factors should be ranked as "Very Good", "Good", "Fair", or "Poor". The ranking procedure follows the Natural Heritage Network's principles for ranking element occurrences (summarized in Chapter IX [*Measures of Conservation Success*]).

Target viability is ranked as "Very Good", "Good", "Fair", or "Poor" based on the explicit assessment and ranking of size, condition, and landscape context (see the *Site Conservation/Measures of Conservation Success* Excel workbook, and Appendix A for step-by-step instructions). The rationale for the viability ranks is as follows:

- ***Very Good.*** Excellent estimated viability. Generally, "Very Good" viability reflects at least two "Very Good" and no "Fair" or "Poor" ranks for size, condition, and landscape context.
- ***Good.*** Good estimated viability. Various combinations of "Very Good" to "Poor" size, condition, and landscape context can result in "Good" viability. In general, "Good" viability reflects at least two "Good", or one "Very Good", and no "Poor" ranks among the three viability factors.
- ***Fair.*** Fair estimated viability. Like "Good" viability, various combinations of "Very Good" to "Poor" size, condition, and landscape context can result in "Fair" viability. However, in general, "Fair" viability reflects at least two "Fair", or one "Poor", and no "Very Good" ranks among the three viability factors.
- ***Poor.*** Poor estimated viability; or not viable. Generally, "Poor" viability reflects at least two "Poor" and no "Good" or "Very Good" ranks for size, condition, and landscape context.

Given the fundamental role of assessing and ranking size, condition, and landscape context in ranking viability, it is essential to document the thinking behind the size, condition, and landscape context ranks assigned to each focal conservation target. You should cite global EO rank specifications when they exist; with some thought, the letter-grade global EO ranks can be translated into site-specific categorical viability ranks. Whether or not global EO rank specifications exist and are the basis for the site-specific viability assessment, you must document the size, condition, and landscape context attributes and ranks that justify the assigned, site-specific viability rank. This documentation should include the changes in these attributes that would cause size, condition, or landscape context to be up-ranked or down-ranked by one class.

As indicated in the heritage methodology, ranks should be assigned strictly within the four classes. A four level ("Very Good", "Good", "Fair", "Poor") scale should be sufficient for ranking the size, condition, landscape context, and viability of focal conservation targets; a scale having finer distinctions cannot be justified given the variability of nature, incomplete knowledge, and limitations inherent in our ability to accurately measure viability.

▶ Consider global EO rank specifications when they exist (e.g. specifications will be published in 2000 for 500 animal species). The global EO letter-grade ranks can be translated into the site-specific categorical viability ranks for Biodiversity Health.

▶ While EO rank specifications have not yet been developed for most ecological communities, the *EO Data Standards* document provides guidance on community EO ranking (see Chapter 5, section 5.6.2). Currently, there is little guidance available for ranking ecological systems and groupings of species.

▶ When EO rank specifications do not exist, site-specific viability rank specifications will have to be developed. Under these circumstances, there is likely to be less precision in ranking the occurrences than ranking occurrences of species and ecological community targets for which global EO rank specifications exist. There is also likely to be greater inconsistency in the rankings across sites.

▶ To help address the challenge of developing site-specific ranking criteria for conservation targets, you can consult with ecoregional planning ecologists and other scientists who are knowledgeable about the target, and use informed judgements and available information to assess the size, condition, and landscape context of the conservation target at the site.

▶ In some cases, TNC and partner scientists participating at sites may be sufficiently knowledgeable to develop EO rank specifications for a conservation target. Templates and examples are provided in Chapter 5 of *EO Data Standards*.

▶ The viability rank of a focal conservation target should be based strictly on its *current* size, condition, and landscape context. A target should not be down-ranked because a threat looms on the horizon. The potential threat could be abated. The threats at the site will be assessed as a separate measurement.

D. *ASSIGN "BIODIVERSITY HEALTH" FOR THE SITE*

Each of the viability ranks has a numerical score assigned to it:

"Very Good"=4.0

"Good"=3.5

"Fair"=2.5

"Poor"=1.0

This scale is a crude approximation of the underlying continuous viability scale. The non-linear numeric relationship among the viability classes reflects the diminishing return of moving up one class as one moves up the scale. For example, the viability score increases by 1.5 in moving from "Poor" to "Fair," but only increases by 0.5 in moving from "Good" to "Very Good."

The average viability score across the focal conservation targets at the site is calculated, and Biodiversity Health for a site is assigned as "Very Good", "Good", "Fair", or "Poor" according to the following grading scale:

>= 3.75	Very Good
3.0 – 3.74	Good
1.75 - 2.99	Fair
< 1.75	Poor

You and your planning/implementation team will need to develop appropriately detailed, cost-effective monitoring procedures to assess the viability (i.e., size, condition, landscape context) of the focal conservation targets. For each focal target, this will require the identification of the attributes that (1) reflect size, condition, and landscape context, (2) are sensitive to change, and (3) are amenable to being monitored. In addition to being the basis of the summary Biodiversity Health measure, this target-specific information can be used for more detailed, site-based decision-making, e.g., the response of individual targets to specific strategies. See the last section of Chapter VIII (*Measures of Conservation Success*) for more information on developing a site-based monitoring program.

The Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains a computer-automated *Systems Viability Worksheet* template that automatically ranks the viability of each selected conservation target, based on an assessment and ranking of size, condition, and landscape context, and assigns Biodiversity Health for the site. Moreover, the worksheet will allow a graphic presentation of the current viability rank of each conservation target.

A "manual" *Systems Viability Worksheet* is provided in Appendix A. This worksheet is analogous to the *Systems Viability Worksheet* in the Excel workbook, and can be copied and filled out manually to compute viability ranks for focal conservation targets and Biodiversity Health for a site.

The Excel workbook also contains a *Related Conservation Targets and Monitoring* worksheet that allows elements of biodiversity subsumed by each focal conservation target to be identified, and the indicators and monitoring parameters for size, condition, and landscape context to be documented. An analogous "manual" worksheet is provided in Appendix B.

The Excel workbook is included on the diskette that accompanied this handbook, or is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org).

V. Stresses

We need to understand the *stresses* affecting the focal conservation targets—as distinct from *sources* of stress—in order to ensure that we develop effective conservation strategies.

At first glance, the distinction between stresses and sources may appear overly complicated or unnecessarily confusing, but it is actually designed to make a complex task easier to understand. More importantly, it is designed to help lead to effective strategies for addressing critical threats. This is well described in *Beyond the Ark*:

> The Nature Conservancy originally called the second step in its [site conservation] planning discipline "threats analysis". Project teams understandably adopted "threat" as the unit of analysis. The Conservancy concluded after a time, however, that its project teams would be better positioned to develop good strategies if they considered threats in two more narrowly defined steps. Team members are now advised to ask first what the ecological stresses to a system are—independent of the source of those stresses—before separately tracing those stresses to their sources. If we do not consciously alter our natural mode of expression, we will, for example, call a proposed road a threat in an estuarine system. We are then immediately inclined to the conclusion that we must stop construction of the road. Threat: road. Solution: stop road. However, if we separate the threat into stress and source, the stress isn't the road. The stress is, for example, loss of tidal flow. That formulation of stress inclines us to think, instead, of ways to keep tidal waters flowing through the pathway that is the proposed location of the road. Culverts may be the answer. (*Beyond the Ark*, by Bill Weeks, p. 46)

In essence, stress is the impairment or degradation of the size, condition, and landscape context of a conservation target, and results in reduced viability of the target. A source of stress is an extraneous factor, either human (e.g., policies, land uses) or biological (e.g., non-native species), that infringes upon a conservation target in a way that results in stress.

What types of destruction, degradation, or impairment are significantly reducing the viability of each focal conservation target at the site? ?

This chapter presents two steps for answering this key question:

1. Identify major stresses to the focal conservation targets
2. Rank the stresses

It is necessary to complete both of these steps before proceeding to an assessment of sources of stress (Chapter VI).

1. Identify Major Stresses to the Conservation Targets

Every natural system is subjected to various disturbances. For our planning purposes, however, only the destruction, degradation or impairment of focal conservation targets resulting directly or indirectly from human causes should be considered a stress. Many or most stresses are caused directly by incompatible human uses of land, water, and natural resources; sometimes, incompatible human uses indirectly cause stress by exacerbating natural phenomena.

The stresses to consider should be happening now, or have high potential to occur within the next ten years. Do not consider past stresses that no longer affect the viability of the target, or those that are possible but have low potential to occur. The damage may be either a direct impact to the conservation target (i.e., degraded size or condi-tion), or an indirect impact via impairment or exacerbation of an important natural process (i.e., degraded landscape context).

The stresses afflicting *each* focal conservation target need to be identified. It is important to be as precise as possible in identifying the stresses; this will help focus the subsequent identification of sources of stress, and minimize double counting of stresses.

Review the size, condition, and landscape context ranks for each focal conservation target. These rankings should help you identify the existing stresses to the target. For example, if size, condition, or landscape context of the target was not ranked "Very Good", what sort of degradation or impairment was the basis for down-ranking the factor?

To identify stresses that have high potential to occur within the next ten years, you must have some sense of the human activities that are likely to become important sources of stress within the ten-year timeframe. For example, a river system may now be undammed, but a dam has been approved and construction scheduled to occur within the next ten years. Operation of the dam is expected to alter the magnitude and timing of peak flood flows that sustain the downstream riparian forest. In this case, altered flood flows should be identified as a stress to the riparian forest (and dam operation would be identified as the source of the stress).

- Conceptual ecological models (see toolbox on page IV-8, and *Supplemental SCP Volume*) may be helpful tools for identifying stresses to conservation targets and sustaining processes.
- An illustrative checklist of stresses is provided in Appendix C and as a drop-down menu in the Excel workbook to aid in the identification of stresses. Use this list as an aid, but consider other stresses that may be relevant and significant. Appendix C also provides some illustrative examples of the identification and ranking of stresses and sources.

A note on mapping stresses: The geographic component of a stress corresponds to the boundary of the conservation target occurrence or natural process afflicted by the stress. Mapping stresses can aid in identifying and locating conservation targets occurrences and sustaining processes that need restoration and ecological management. Additional information on site-based boundaries can be found in the *Supplemental SCP Volume*.

2. Rank the Stresses

The relative seriousness of a stress is a function of the following two factors:

- ***Severity of damage.*** What level of damage to the conservation target over at least some portion of the target occurrence can reasonably be expected within 10 years under current circumstances? Total destruction, serious or moderate degradation, or slight impairment?
- ***Scope of damage.*** What is the geographic scope of impact to the conservation target expected within 10 years under current circumstances? Is the stress pervasive throughout the target occurrences, or localized?

Based upon the best available knowledge and judgments, for each stress to each priority conservation target that you've identified, rank the severity and scope as "Very High", "High", "Medium", or "Low". The stress is then ranked, using the same four classes, based on the assessment of severity and scope (see the Microsoft Excel *Site Conservation/Measures of Conservation Success Workbook,* and Appendix A). The guidelines for ranking severity and scope, and the rules for combining severity and scope into a stress rank are presented in Appendix A. You want your conservation strategies to reduce or eliminate those stresses that have high severity combined with wide scope. You should not be as concerned about a stress with very severe impacts to only a small area, or stresses that are widespread but with low severity.

This method of characterizing and assessing stresses is, in part, the basis for making the Threat Status and Abatement measure of conservation success at sites.

Some stresses, while not seemingly widespread or severe, may actually be at or near a threshold of irreversibility. That is, the severity and/or scope of the stress may remain relatively small over the next ten years but in the future will increase inexorably and be impossible to reverse if the source of stress is not abated within the next ten years. Stresses caused by non-native invasive species often fall into this category.

For example, consider a grassland system with a few, small infestations of a non-native invasive weed; these infestations alter the composition and structure of the grassland. At face value, the scope of the stress (altered composition/structure) is "Low"; combined with "Very High" severity, the overall stress rank is "*Low*". However, the invasive species can be eliminated or prevented from spreading only if caught at this time when small in number and extent. Once the distribution of the invader, and thus the scope of the stress, reaches a threshold size (which may be small relative to the size of the whole grassland occurrence), it becomes, for all intents and purposes, impossible to eliminate—it will eventually spread unabated throughout the occurrence. In this case, if the invasive weed and corresponding altered grassland structure and composition are expected to reach this threshold within ten years under current circumstances, then a more appropriate stress rank would be "*Very High*". Under circumstances such as these, you should override the stress rank suggested by the scoring tables and use the more appropriate higher rank.

Note: if overriding the ranking suggested by the scoring tables is necessary, it is extremely important to document your rationale for doing so.

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains computer-automated *Stresses/Sources Worksheet* templates that automatically rank the identified stresses to each target based on an assessment of severity and scope. The Excel workbook is included on the diskette that accompanied this handbook, and is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). A set of "manual" *Stresses/Sources Worksheets* is provided in Appendix A. These worksheets are analogous to those in the Excel workbook, and can be copied and filled out manually to determine the stress ranks.

VI. Sources

For each stress afflicting a given conservation target, there are one or more causes or sources of the stress.

For example, nutrient loading is a stress to many aquatic ecosystems, where excess nutrients in the water draw off oxygen and therefore kill fish and other aquatic life. However, the nutrient loading might be caused by many different sources, such as farm fertilizers, animal feed lots, septic systems, sewage treatment facilities, or suburban runoff.

What is most causing the destruction, degradation, or impairment of the priority conservation target(s) at the site?

?

This chapter presents four fundamental steps for answering this key question, and for assessing the Threat Status and Abatement measure of success:

1. Identify sources of stress
2. Rank the sources
3. Identify critical threats and persistent stresses
4. Assign "Threat Status" for the site

The first three steps are prerequisites for developing conservation strategies (Chapter VII)—and for measuring threat status of the site. The fourth step is specific to measuring threat status.

1. Identify Sources of Stress

Most sources of stress are rooted in incompatible human uses of land, water, and natural resources. Such incompatible uses may be happening now (e.g., surface water diversion, inappropriate livestock grazing), or may have happened in the past but left either a legacy of persistent stresses (e.g., altered composition and structure) or other sources of stress (e.g., feral pigs, kudzu).

The source(s) of each stress afflicting each conservation target need to be identified. Each stress must have at least one source, and may have multiple sources.

When identifying sources of stress, it is important to distinguish between "active" and "historical" sources. An active source is expected to deliver *additional* stresses to a conservation target within the next ten years. These include ongoing sources as well as those that are likely to become active within the ten-year timeframe.

Historical sources are no longer active, and thus are expected to deliver *no additional* stresses to a conservation target. An historical source should be listed if the stresses caused by the source are expected to persist over the next ten years. For example, the condition (i.e., composition, structure, continuity) of a forested system may have been degraded by past timber harvest. Through change in land ownership or timber management policy, timber harvest is no longer occurring—the source of stress has been abated. However, the condition of the forest system is still degraded from past timber harvest—the forest is still stressed—and is not expected to recover by itself within the next ten years. In this instance, the stress would be identified as altered composition/structure, the "historical" source of stress would be identified as incompatible timber harvest practices, and there would be no "active" source of stress.

Also, it is important to identify the most proximate sources (e.g., incompatible timber harvest) rather than ultimate or indirect sources (e.g., human population growth). Indirect sources of stress will be identified and considered when developing conservation strategies.

Finally, it is critical to identify the source precisely, because addressing each different source often requires a very different conservation strategy. For example, many priority systems are stressed by incompatible residential development. However, different aspects of incompatible residential development are relevant to different stresses. In one riverine system, the highest ranked stress was hardening of the shoreline. The apparent source of stress was second home development along the river. However, the density of development, the pattern of sprawl, the septic systems, and the fragmentation associated with second home development were not the critical sources—rather it was the actual bulkheads and groins built along the riverbank. A strategy to address this particular threat could be much more precise, effective, and accomplishable than a strategy to "control growth" in this rural area.

An illustrative checklist of sources of stress is presented in a pull-down menu in the *Site Conservation/Measures of Conservation Success* Excel workbook and in Appendix C. Use this list as guidance, but consider other sources of stress that may be appropriate at your site. In addition, using definitive subcategories may be helpful. The more precisely the source is defined, the easier to design effective threat abatement strategies.

Appendix C also provides some illustrative examples of the identification and ranking of sources of stress.

A note on mapping sources of stress: The boundaries of sources of stress depict where on the landscape the human or ecological factors that cause stress to the conservation targets or sustaining processes occur. Sources of stress may or may not be coincident with the stresses they cause. For example, a nonnative fish species may cause stress in the form of extraordinary competition to the native fishes with which it co-occurs—the source and the stress are coincident. On the other hand, inappropriate forestry practice in the upper watershed may cause excessive sedimentation, which stresses a downstream aquatic community—the source and the stress are disjunct or not coincident. Additional information on site-based boundaries can be found in the *Supplemental SCP Volume*.

2. Rank the Sources

The relative seriousness of a source is a function of the following factors:

- ***Degree of contribution to the stress.*** The contribution of a source, acting alone, to the full expression of a stress (as determined in the stress assessment), assuming the continuation of the existing management/conservation situation. Does (or did) the particular source make a very large or substantial contribution to causing the current stress, or a moderate or low contribution?

- ***Irreversibility of the stress.*** The reversibility of the stress caused by the source. Does (or did) the source produce a stress that is irreversible, reversible at extremely high cost, or reversible with moderate or little investment?

Based upon the best available knowledge and judgments, rank each source with respect to each stress it causes. Rank the contribution and irreversibility as "Very High", "High", "Medium", or "Low". The source is then ranked, using the same four classes, based on the assessment of contribution and scope (see the Microsoft Excel *Site Conservation/Measures of Conservation Success Workbook,* and Appendix A). The rules for combining contribution and irreversibility into a source rank are presented in Appendix A.

When multiple sources all contribute to a given stress, we want to focus our threat abatement strategies on the source or sources that are most responsible for the stress. We also want to focus on those sources that, if allowed to occur at a site, will cause long-term impacts (e.g., housing development).

3. Identify Critical Threats and Persistent Stresses

The final step in the assessment of stresses and sources is a synthesis of the individual stress and source analyses to identify the critical threats and persistent stresses to the conservation targets.

A "threat" is actually a combination of a stress and a source of stress. Critical threats are those highly ranked threats that have an active source of stress. For taking corrective action, the active source is the thing on which the Conservancy must focus its *threat abatement strategies*, under the assumption that abatement of the source will alleviate the stress and result in higher viability of the conservation target(s).

Highly ranked threats that have an historical source are best thought of as persistent stresses since the source component of the threat is no longer active. The Conservancy must focus its *restoration strategies* on directly reducing persistent stresses.

Identifying critical threats and persistent stresses has three steps: For each conservation target, (1) calculate a Threat rank for each stress-source combination, and (2) combine the Threat ranks for each source into a Threat-to-System rank. The Threat-to-System rank represents the degree to which a particular source of stress causes stress to a given conservation target. Finally, for each source of stress, (3) combine the Threat-to-System ranks across conservation targets into a Overall Threat rank of "Very High", "High", "Medium", or "Low". The Overall Threat rank represents the degree to which a particular source causes (active sources) or has caused (historical sources) stress to the focal conservation targets at the site. The Overall Threat ranks for threats with active and historical sources, respectively, are summarized in separate tables. The rules for combining Threat ranks into Threat-to-System ranks, and Threat-to-System ranks into Overall Threat ranks are described in Appendix A. (*Note: this process is more easily understood by running through the* Stresses/Sources *and* Threat Summary *worksheets in the* Site Conservation/Measures of Conservation Success *Excel workbook and in Appendix A.*)

The critical threats are those active sources of stress with "Very High" (and perhaps "High") Overall Threat ranks.

The persistent stresses are the "Very High" ranked stresses caused by the historical sources of stress with "Very High" (and perhaps "High") Overall Threat ranks.

Note: Completing these three steps is a prerequisite for developing conservation strategies (Chapter VII) and for measuring the threat status of a site. The fourth step, below, is specific to measuring the threat status. We strongly recommend that you complete step 4 before moving on to developing conservation strategies.

4. Assign "Threat Status" for the Site

The Threat Status of the site is assigned as "Very High", "High", "Medium", or "Low" based on the assessment of the eight highest ranked critical threats. (Eight was determined to be the number of threats that is small enough to provide focus on the most critical threats while being large enough to show threat abatement over time.) With all sites using the same number of threats for purposes of calculation, the Conservancy can see at a glance the relative degree of threat at its full portfolio of sites.

The rules used for combining the eight highest Overall Threat ranks into Threat Status are described in Appendix A.

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains computer-automated *Stresses/Sources Worksheet* templates that automatically rank the identified sources of stress based on an assessment of contribution and irreversibility, and automatically determine Threat-to-System ranks. The workbook also contains a *Threat Summary Worksheet* template that automatically determines the Overall Threat rank for each source of stress, and the Threat Status of the site. The *Threat Summary Worksheet* will allow a graphic presentation of the current Overall Threat rank of each source of stress. The Excel workbook is included on the diskette that accompanied this handbook, and is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). A set of "manual" *Stresses/Sources and Threat Summary Worksheets* is provided in Appendix A. These worksheets are analogous to the worksheets in the Excel workbook, and can be copied and manually filled out to determine Source, Threat, Threat-to-System, and Overall Threat ranks, and to assign Threat Status to the site.

VII. Conservation Strategies

The way we respond, or fail to respond, to the critical threats and persistent stresses will very likely be the ***single most important factor*** affecting the long-term viability of the priority conservation targets at the site.

The ultimate objective of our conservation strategies is to reduce the stresses that are degrading and impairing, and thus lowering the viability of, the focal conservation targets. There are two major paths for accomplishing this objective (see Figure 2, Chapter IV). The first is to abate the critical threats, i.e., remove the active sources of stress, under the assumption that the associated stress will decrease if the source is removed. This is the objective of *threat abatement strategies*. However, in some instances, even if the active source is abated, the stress to the target may persist. In these instances, it will be necessary to deploy *restoration strategies*, with the objective of directly reducing the persistent stress. Also, at times it will be necessary to deploy strategies that build capacity, engage stakeholders, or promote priority policy actions rather than directly abate threats or reduce persistent stresses. Such indirect strategies have high leverage in that they pave the way for more direct threat abatement and restoration strategies.

What strategies will best abate the critical threats and persistent stresses to the conservation targets? ?

This chapter presents four fundamental steps for identifying and assessing conservation strategies and setting priorities for action:

1. Consider the array of strategic approaches
2. Develop a list of potential strategies
3. Rank the proposed strategies
4. Consider top priorities for immediate action

1. Consider the Array of Strategic Approaches

Broadly speaking, there are three complementary strategic approaches that can be deployed to abate the critical threats and reduce the persistent stresses that degrade the viability of the conservation targets:

Land and Water Conservation

Directly establishing land and water uses and resource management that are compatible with the maintenance of the targeted systems, and ensuring their short- and long-term application, is the objective of land and water conservation strategies. This strategic approach focuses directly on resource protection and management, and includes *acquisition of interest in land or water* and *adaptive* *management of public and private lands and waters.*

- **Acquisition of Interest in Land or Water**
  To ensure appropriate land or water use and management for the long term, highly significant natural areas and water resources may require *acquisition of fee interest* by a local land trust, a public resource agency, The Nature Conservancy or other group with a mission of protecting such resources. *Conservation easements* offer permanence in land protection, while retaining land in private ownership. They may range from simple prescriptions for open space to detailed standards and goals for managing significant natural resources. Private landowners and public land managers may enter into a *management lease* with a non-profit conservation group or a state or local agency, such as a soil conservation office.

- **Adaptive Management of Public or Private Lands and Waters**
  Critical threats and persistent stresses may be abated and conservation targets maintained, restored, or enhanced through proper management of land, water, and other natural resources. Communities can educate, encourage, and reward landowners and managers who follow best management practices for farming, grazing, forestry, or aquaculture on their property. Strategies to establish resource management and restoration programs that recognize and address the uncertainty of how the ecolo-gical system will respond to management and restoration actions fall within the rubric of adaptive management strategies.

Public Policies

Some threats to biodiversity can be addressed most effectively through good public policy. For example, haphazard residential growth and urban sprawl fragment significant ecosystems across the country, not only near growing cities and suburban areas but also in rural and coastal landscapes. To address this threat, local comprehensive plans and development standards are needed to define, design, and locate the types and amount of development that meets community needs, protects the local environment, and generates a fair economic return. A community might provide financial incentives like tax abatements or purchase of development rights to keep land in traditional land uses, such as farming and forestry.

Because threats operate at various scales, not all threats can be addressed simply through local policies. Regional and national policy initiatives —such as the combined efforts of Maryland, Virginia, and Pennsylvania to clean up the Chesapeake Bay and revitalize its fisheries—are also needed. These policies must be founded on good information and public support.

Compatible Development Alternatives

Most threats to biodiversity ultimately are caused by incompatible human economic activities. To address these threats, we must often do more than appropriately use and manage resources, and foster good policies that prevent incompatible activities and development. We must actively develop, promote, and implement compatible development alternatives.

Compatible development is the production of goods and services, the creation and maintenance of businesses, and the pursuit of land uses that conserve biodiversity, enhance the local economy, and achieve community goals.

Any or all of these strategic approaches may require **community-based programs** designed to secure short-term and long-term community support.

Landscape-Scale, Community-Based Conservation: A Practitioner's Handbook provides more detailed information on community-based programs and building community support as conservation strategies. The handbook and additional information are available upon request from the Center for Compatible Economic Development. [contact Carolyn Georgen, cgeorgen@cced.org]

2. Develop a List of Potential Strategies

Review your list of critical threats, e.g., those active sources of stress with "Very High" and "High" Overall Threat ranks. Consider the array of conservation strategies that might abate or preempt these critical threats.

Also, review the list of persistent stresses, i.e., those "Very High" ranked stresses caused by historical sources with "Very High" or "High" Overall Threat ranks. Consider conservation strategies that might directly reduce these stresses and directly enhance or restore the viability of affected conservation targets.

Hint: It is important to state each conservation strategy as precisely as possible. For example, "control residential development" is too broad a statement of strategy. "Secure an improved local development ordinance to manage overall development density in agricultural areas" is a more focused strategy statement.

Because critical threats typically stem from incompatible economic activities in the immediate or adjacent human communities, an understanding of the cultural, political, and economic context that represents the driving forces (i.e., indirect or ultimate sources) behind the critical threats is essential for developing sound conservation strategies. In developing strategies, it is important to consider the following two key questions:

What are the key characteristics (economic, political, cultural) of the local human communities, as related to the critical threats and conservation targets?

Which individuals, groups, or institutions are likely to affect or be affected by conservation action?

The *Supplemental SCP Volume* provides additional information on assessing human context factors (e.g., land use, economic activities, policies, cultural attitudes and norms, and constituencies and stakeholders) as the basis for identifying high priority strategies.

3. Rank the Proposed Strategies

Potential strategies to abate the critical threats and persistent stresses should be evaluated and ranked using three criteria: *Benefits*, *Feasibility and Probability of Success*, and *Costs of Implementation*.

Benefits

Benefits result from *abating critical threats, reducing persistent stresses*, and *developing opportunities and building support for conservation.* Benefits can be both direct (e.g., cows fenced out of stream, or size of target occurrence increased by fifty percent) and indirect (farmer/rancher education program launched). Some benefits that seem small or less tangible can provide an important foundation for future actions. Consider the marginal benefits that would arise from implementing the strategy. If the results would likely occur anyhow, without special actions by you and your conservation partners, don't rank the benefits highly.

To assess the potential benefits of a proposed conservation strategy, consider three factors:

- **Threat Abatement**
  The degree to which the conservation strategy is likely to reduce the Threat rank of one or more threats with active sources. This benefit will accrue only through threat abatement strategies, which focus on active sources of stress.

- **Reduction of Persistent Stresses**
  The degree to which the conservation strategy is likely to reduce the persistent stresses (i.e., those stresses with historical sources). This benefit will accrue only through restoration strategies, which focus on the direct reduction of stresses that have historical but no active sources.

- **Leverage**
  Frequently, the most effective strategies are catalytic in nature—a little bit of effort or a small investment triggers positive work or resources from others, and other new opportunities. High-leverage strategies pave the way for other strategies.

There is no shortage of worthwhile ideas. There **is** *a shortage of resources for getting things done. You must be hard-nosed in evaluating the benefits of your proposed actions.*

Feasibility and Probability of Success

All other things being equal, a program should invest in the strategies that are the most likely to succeed, in light of potentially available human and financial resources, as well as existing circumstances. The probability of successful implementation depends on many variables, but two key factors are perhaps most critical:

- **Lead Person and Institution**
  Perhaps the single most important factor of success is finding the right person to take the lead and the responsibility to implement the strategy.

- **Ease and Lack of Complexity**
  Despite the best plans and the best people, there are myriad forces outside of anyone's control that can cause plans to succeed, fail, or change. *The more complex the strategy, the more likely that unanticipated outside events will substantially affect the outcome. For this reason, it is wise to invest in some relatively small, simple, do-able strategies.* Evidence of success will

then help encourage your conservation partners to undertake challenges that are more complex.

Costs of Implementation

There is one cost factor to consider:

- **Commitment of Limited Discretionary Resources**
  There are limited human and financial resources to invest in the future. Special attention should be paid to the commitment of limited discretionary resources required to implement a conservation strategy. While discretionary resources are limited, there may be opportunities to secure new resources that might be earmarked for a particular strategy.

Based upon the best available knowledge and judgments, rank each strategy as "Very High", "High", "Medium", or "Low". The ranking should be based on the explicit assessment of the benefits, feasibility and probability of success, and cost of implementation (see Appendix D).

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains computer-automated templates that automatically determine the target-specific benefits of each selected conservation strategy, as well as the overall strategy rank based on an assessment of benefits, feasibility and probability of success, and costs of implementation. The Excel workbook is included on the diskette that accompanied this handbook, and is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). A "manual" *Summary of Strategies Worksheet* is provided in Appendix D. This worksheet is analogous to the *Summary of Strategies Worksheet* on the Summary sheet of the Excel workbook, and can be copied and filled out manually to determine strategy ranks. However, we highly recommend that you use the Excel workbook to rank the target-specific benefits of the conservation strategies.

4. Consider Top Priorities for Immediate Action

Working from the list of highest ranked strategies, select a small number for immediate implementation. Look for the strategies that will produce high benefits with the greatest chance of success and affordable costs. The best people and discretionary resources should be focused early on the highest leverage ideas.

- ***Pick early winners***—those actions that are the most likely to succeed and offer tangible results. Strive to show early success that rein-forces the interests and issues important to partners and key sectors in the community. Success then tends to beget more success.
- ***Pick big winners***—Carefully consider strategies that may be big winners. Adequate resources and staff experience are needed to launch complex, high-leverage projects. In addition, a more difficult and complex strategy often needs a foundation of smaller successes. The temptation to tackle big projects must be weighed against the perils that the project could bog down or cause tension in fragile community or partner alliances.

▶ There is often confusion between objectives and strategies. An objective is a desired state or end of action—something toward which effort is directed. For site conservation planning purposes, abatement of critical threats and persistent stresses are the general objectives, and strategies are the means to these ends. More specific objectives can be articulated for individual strategies. Don't worry about the technical differences in these terms. Just clearly state what needs to be done to abate the critical threats and persistent stresses to the conservation targets. Meeting these objectives will translate into meeting the site-based conservation goals, i.e., the maintenance and enhancement of the viability of the conservation targets.

▶ For purposes of describing your program, group together related, action-oriented strategies into a smaller set of three to five strategic initiatives or strategic priorities—these groupings help keep the focus on the bigger picture.

▶ Different strategies are often linked. For example, demonstrating a successful compatible residential development approach could help lay the groundwork for an improved land use plan and development ordinance. Look for these linkages.

▶ Strategies should not be viewed as fixed plans. Circumstances change as work proceeds and strategies must change accordingly. Use the Five-S framework to incorporate changing circumstances into your decision-making process, and update and refine strate-gies as needed.

▶ Time frames for strategies differ. Some things can be accomplished in relatively short order. Other things will require a long, persistent effort. Recognize and be prepared to do both.

A Note on Implementation of Strategies

Although implementation of strategies is beyond the scope of this handbook, there are two related issues that need to be mentioned: Implementation Plans and Conservation Zones.

What actions are necessary to implement the conservation strategies? Who will do them, when will they be done, how long will they take, and how much will it cost?

Where are the areas on the ground in which specific conservation strategies and actions apply?

Addressing these two key questions will help ensure that staff and financial resources are applied in the appropriate ways and in the appropriate places within the site to best implement conservation strategies and achieve conservation success.

A more in-depth discussion of implementation plans and of issues related to mapping strategy boundaries (i.e., conservation zones) is provided in the *Supplemental SCP Volume*.

A note on mapping strategies: Strategy boundaries locate those places where we must take conservation action either to abate threats or restore conservation targets. Threat abatement strategies generally coincide with the location of the **sources of stress** to be abated, restoration strategies with the degraded or impaired target occurrences and processes (**systems**) to be enhanced or restored. Conservation strategies that are general or programmatic in nature (e.g., community education program; participation in a multi-agency endangered species recovery program) may not be amenable to mapping.

VIII. Measures of Conservation Success

The Nature Conservancy has defined conservation success as making substantial progress towards (1) the long-term abatement of critical threats and (2) the sustained maintenance or enhancement of conservation target viability at sites identified for Conservancy action.

Are threats being abated, and is the viability of conservation targets being maintained or enhanced?

?

This key question can be answered at two levels: for individual threats and targets, and for the site as a whole. Tracking changes in the status of individual threats and conservation targets allows the effectiveness of individual conservation strategies to be assessed, and adjustments in our conservation actions to be made, as appropriate—this is an essential feature of the adaptive, dynamic Five-S site conservation process.

As an organization, the Conservancy needs a simple yet compelling method for assessing conservation progress across sets of sites (e.g., sites within an ecoregional portfolio). The target- and threat-specific assessments, while appropriate for site-specific decision-making, are too detailed for this purpose. What is needed are more general, site-level measures of conservation success. The Conservancy has developed two measures of conservation success for this purpose:

- ***Biodiversity Health***—the viability of focal conservation targets at a site.
- ***Threat Status and Abatement***—our success in abating critical threats to the conservation targets at a site.

Over the next ten years, these two conservation measures will be applied to high priority sites where the Conservancy is engaged in conservation action—TNC "action sites." The measures will initially be applied to all sites targeted in the Conservancy's capital campaign and then expanded to include all action sites identified by ecoregional plans, as they come "on line." In ten years, the measures will include the 2,500 action sites in the United States that contribute to the domestic ten-year goal, and the 100 action sites in other countries that contribute to the international goal. Eventually the measures will be applied to the entire portfolio of sites identified by ecoregional plans.

As the conservation measures are focused on *site* conservation, they do not attempt to track the hundreds or thousands of conservation targets within each ecoregion (which would be a complex and costly measurement and data management operation) or assess progress towards target-specific ecoregional goals.

The Biodiversity Health measure assesses the effectiveness of our conservation strategies at enhancing or maintaining the viability of the focal conservation targets. It is based on the viability assessment of individual focal conservation targets. The Threat Status measure assesses the effectiveness of our conservation strategies at abating or removing critical threats. It is based on the assessment of stresses and their sources to individual focal conservation targets. These two measures provide a necessary assessment of our net conservation impact at the site. As an organization, our results as shown by these two measures over time are what matters.

However, there is often a lag-time between implementation of conservation strategies and abatement of the critical threats and persistent stresses, and an even longer lag-time between strategy implementation and showing changes in biodiversity health. Accordingly, we also have developed a set of short-term indicators that reflect our *capacity* to implement effective strategies at action sites.

Criteria for the Measures of Conservation Success

The Conservancy's conservation measures are designed to meet the following criteria:

Measure Results Towards 10-Year Conservation Goals

The measures focus on conservation sites where the Conservancy is substantially engaged in conservation activity, working directly and/or in cooperation with its partners. This is the primary design criterion for the measures; the other criteria are subordinate to this criterion.

Encourage Right Action

The measures, and the assessments upon which they are based, should encourage practi-tioners to implement efficient and cost-effective strategies to abate critical threats at priority sites. The prevention or reduction of threats, in turn, should lead to maintenance or enhancement of the health of key conservation targets at the sites. In some instances, actions must be taken to restore conservation targets at sites.

Functional

No set of measures will be a perfect instrument, especially in dealing with the complexities of nature and our imperfect understanding of biodiversity, viability, and human impacts on the natural world. Moreover, any classification or grading system by definition categorizes the continuum of the real world. We have sought to establish functional, affordable measures that will reasonably inform us about our progress towards our 10-year conservation goals.

Clear and Compelling

The measures should be clear, compelling and understandable to every staff member and trustee of the Conservancy. While complex conservation science may underlie the measures, the application of the measures should be compelling in substance, language and presentation.

- The measures should be presentable in graphs or figures, allowing us to see results clearly, as well as see improvements over time.
- The measures should be presented in color maps, allowing us to see at a glance the status of our progress in conserving priority sites within a given ecoregion, state, division or country.

▸ ▸ ▸ ▸ Biodiversity Health, Threat Status, and Conservation Capacity ◂ ◂ ◂ ◂

Biodiversity Health

Biodiversity Health measures the estimated viability of the focal conservation targets at a site. It uses a methodology analogous to that employed by the Natural Heritage Program for ranking the viability of conservation target occurrences. The ranks for the individual focal conservation targets are then consolidated into a Biodiversity Health rank for the site: "Very Good", "Good", "Fair", or "Poor".

▶ **Foundation**

The foundation for measuring biodiversity health is the elegant and long-lived "element occurrence" (EO) ranking system developed by the Conservancy and used throughout the Natural Heritage Network. Since 1974 the natural heritage programs have routinely used this methodology to assess the viability of actual occurrences of ecological communities and species on the landscape. An ecological community or species occurrence is ranked according to its estimated *viability*—the likelihood that the element will persist at the existing location over a specified time period (typically 20 to 100 years)—based on a succinct assessment of its **size**, **condition**, and **landscape context**. A viable ecological community or species has sufficient size and resilience to survive occasional natural disturbances and human stresses. For a given conservation target, a set of EO rank specifications defines the different ranks. These specifications are developed with respect to all known occurrences within the range of the target.

The EO ranking system uses simple letter grades, as follows:

"A"=Excellent estimated viability
"B"=Good estimated viability
"C"=Fair estimated viability
"D"=Poor estimated viability; or, not viable

In assessing viability for Biodiversity Health, there are two significant points of departure from the global EO ranking methodology. First, unlike a global EO rank, which is determined relative to all known occurrences within the range of the target, a "site-specific" viability rank for assessing Biodiversity Health is determined relative to only the occurrences of the target at the site, not to all known occurrences. Second, the definitions of condition and landscape context are slightly different. Thus, the site-specific rank, while based on the same principles as an EO rank, is not identical to an EO rank. For this reason, Biodiversity Health uses categorical ranks that are analogous to but on a different relative scale than the EO letter-grade ranks: "Very Good", "Good", "Fair", and "Poor".

A recently drafted set of standards for assessing the viability of species and ecological communities is now available, as Chapter 5 (*EO Ranks and EO Rank Specifications*) in the document entitled *Draft EO Data Standards* [available on the internet at http://dvic2.tnc.org/eodraft/index.htm]. The standards describe in detail the consideration of size, condition and landscape context in determining the viability of an ecological community or species occurrence at a site relative to all known occurrences. Ecoregional plans have used EO ranks in selecting the portfolio of sites. However, it is important to remember that, as described above and in Chapter IV (*Systems*), the global EO rank specifications are not identical to the site-specific viability ranks for Biodiversity Health; they should be used as a guide only.

Given the dearth of formal EO rank specifications and the flexibility that site planning teams have in defining focal conservation targets, site-specific viability ranks are likely to be the rule rather than the exception for the near future.

▶ **Application of Biodiversity Health**

The step-by-step procedure for measuring biodiversity health at a site is presented in Chapter IV (*Systems*).

▶ **Maps**

The Biodiversity Health measure for a site is translated into one of four colors for the purpose of display on maps.

- Dark Green indicates "Very Good" health
- Light Green shows "Good" health
- Yellow means "Fair" health
- Red indicates "Poor" health.

Maps can show the biodiversity health of sites by state, ecoregion or nation.

▶ **Frequency of Measure**

After an initial baseline measurement, biodiversity health is typically reassessed every three to five years. The actual frequency should be based on the time-scale for observing changes for the focal conservation targets. Some targets may need to be assessed more frequently, but typically a long lead-time is needed to observe meaningful changes in biodiversity health, especially given the variability of natural conditions.

▶ **Responsibility**

State/country programs are responsible for conducting the measures. Biodiversity health typically is assessed by a Conservancy ecologist/scientist(s) knowledgeable about the site. Actual information may come from a variety of sources, such as public agency staff, researchers, or other partner organizations. The lead Conservancy scientist consults with the lead Conservancy practitioner responsible for conserving the site, as well as with Heritage staff or other scientists or partners, as appropriate.

Threat Status and Abatement

Threat Status and Abatement (Threat Status) measures the seriousness of the critical threats at the site, and our success in abating these threats over time. The eight most serious threats are combined into a Threat Status rank for the site: "Very High", "High", "Medium", or "Low".

▶ **Foundation**

The systems, stresses, and sources compo-nents of the Conservancy's Five-S framework for site conservation lay the foundation for the Threat Status measure. The Five-S framework was described in Chapter III (*The Five-S Framework for Site Conservation*), and the systems, stresses, and sources components described in more detail in Chapters IV, V, and IV, respectively.

▶ Application of Threat Status

The step-by-step procedure for determining the threat status at a site is described in Chapters IV (*Systems*), V (*Stresses*), and VI (*Sources*). It will be necessary to complete all of the steps described in each of these chapters to measure threat status.

▶ Maps

As with the Biodiversity Health, Threat Status is translated into four colors for the purpose of displaying it on maps.

- Dark Green indicates "Low" threats
- Light Green shows "Medium" threats
- Yellow means "High" threats
- Red indicates "Very High" threats

The same base maps are used as for Biodiversity Health. Maps can show the threats status at sites by state, ecoregion or nation.

▶ Frequency of Measure

After an initial baseline measurement, threat status is typically re-assessed every two to three years. The actual frequency should be based on the time-scale for observing changes at the sites. Typically conservation strategies must be deployed over a few years to observe meaningful changes in the status of threats. However, a major land protection project, for example, might change the Threat Status dramatically (e.g. from red to green).

▶ Responsibility

State/country programs are responsible for conducting the measures. Threat Status typically is assessed by a team including the Conservancy staff practitioner responsible for the site's conservation and a knowledgeable Conservancy ecologist/scientist working at or with the site. Actual information may come from a variety of sources, such as public agency staff, researchers, or other partners.

Conservation Capacity

The Conservancy's ten-year conservation goals emphasize those conservation sites in ecoregional portfolios where the Conservancy will play a substantial conservation role—Conservancy action sites. Action sites lend themselves to a focused project approach drawing on the Conservancy's unique capabilities, including in some cases a project director with designated responsibility for conserving the site. Our experience to date indicates that three key factors account for success at action sites:

- Project Leadership and Support.
- Strategic Approach.
- Adequate Funding.

Building these capacity factors, in turn, allows us to implement strategies that abate critical threats and enhance or maintain the conservation targets.

For Conservancy action sites, a total of seven indicators of the three key success factors are scored to determine the overall Capacity at a site.

▶ Application of Conservation Capacity at Action Sites.

1. *Verify the Type of Project.*

Conservation Capacity is assessed only for sites where the Conservancy is playing a meaningful conservation role, i.e., Conservancy action sites. The Conservancy's project activity at action sites typically will fall into one of three categories:

- **Conservancy-led projects**
  In which TNC is taking a primary leadership role in conserving the site, typically through the leadership of a Conservancy project director (e.g. most U.S. bioreserves).
- **Joint ventures with partners**
  In which TNC is teamed up with one or more partners—typically via a memorandum of agreement—to put staff and resources in place for site conservation (e.g. Cosumnes River, California, where the local project director is funded and managed jointly by TNC and BLM).
- **Partner-led projects**
  In which the Conservancy plays a substantial supporting role assisting a partner organization that assumes primary responsibility for conserving the site (e.g. most international projects).

The application of Conservation Capacity to action sites is triggered when TNC engagement begins at the site.

2. *Assess Capacity Using Seven Indicators.*

To help evaluate Conservation Capacity, a set of indicators has been developed for each of the key success factors, along with suggested benchmarks for evaluating each indicator. The indicators are listed below, along with a description of the highest benchmark of capacity. The complete set of benchmarks is provided in Appendix E. The benchmarks allow each indicator to be scored on a 4.0 to 1.0 grading scale.

- **Project Leadership and Support**
  The presence of a talented project director is the single most important element of success. This person may be a Conservancy staff person, but might also be a conservation partner who works for a public agency or private conservation organization. The project director

> Landscape action sites require a project director and often a community-based approach to conservation. A set of core competencies has been identified for project directors, and a hiring guide published for managers (*Competencies for Community-Based Conservation Leaders: A Hiring Guide*, available upon request from the Conservation Operations Division [contact Susan Spellman, sspellman@tnc.org]). Managers are strongly encouraged to evaluate the competencies of the local project director during the project director's introductory employment period. A recommended evaluation format for core competencies is included in the hiring guide.

is assigned responsibility for site conservation, and has sufficient time to focus on developing and implementing conservation strategies at the site(s). Landscape action sites require a full-time project director, whereas a less than full-time project director may be sufficient at other action sites.

In addition, the project director needs to be able to call upon an experienced ecosystem conservation practitioner—to serve as a sounding board for ideas, to provide advice and counsel, to provide contacts with outside sources of assistance, and to provide hands-on help at the site when needed. The project also needs to receive regular, high-level assistance from a full-service, experienced support team—either via on-site staff, from the state/ country program staff, and/or from other sources.

The three indicators related to Project Leadership and Support include:

Focused Staff Responsibility for Conservation
A staff member from the Conservancy or a partner organization has clearly assigned responsibility, authority, and account-ability for conserving the site, with adequate experience and sufficient time to focus on developing and implementing conservation strategies at the site.

Conservation Manager or Mentor
The project has regular, sufficient (relative to site need), ongoing, hands-on involvement by an experienced conservation manager or mentor (i.e., at least five years experience *and* proven results in conserving sites with a similar level of complexity).

Project Support Team
The project receives regular, high-level assistance from a full-service, experienced support team, including conservation science, protection, land and water management, applied research, government relations/pub-lic funding, development, and operations. The support may be provided via on-site staff, state, country, international program, or partner organization staff.

- **Strategic Approach to the Project**
The strength of our strategic approach underlies our success in site conservation. The two indicators of Strategic Approach are:

Understanding/Application of the Five-S framework (systems, stresses, sources, strategies, success)
The staff project director and a multi-disciplinary team have completed a thorough assessment of the five "S's" and have developed a sufficiently documented site conservation plan and appropriate site maps. (The assessment must be consistent with the spirit, not necessarily the letter, of the Five-S framework. No matter what formal planning process is used [e.g., one dictated by local, state, or federal policy], the identification of and logical linkage between systems, stresses, sources, strategies, and success must be apparent).

Iterative, Adaptive Approach to Developing and Implementing Key Conservation Strategies
Key components of ecological systems and threat status are monitored, and a multi-disciplinary project team meets regularly (e.g. quarterly, semi-annually, or annually) to assess progress, evaluate results based on monitoring of appropriate indicators of viability and threat, review and test strategic hypotheses, and make necessary strategic adjustments

- ***Project Funding and Sustainability***

  The local project must have sustainable operational funding that is adequate to support the local staff director and operating costs, as well as program funding that is adequate to implement key strategies. Funding may come from both private and public sources. There are two indicators related to Project Funding and Sustainability:

  Start-Up or Short Term Funding
  Funding has been secured, pledged, or is highly probable for core operations for at least the first two years, as well as major private or public funds to implement key conservation strategies.

  Sustainable Support
  The project has sufficiently developed a mix of long-term funding (broad donor base, endowment, or predictable funding), community support, and institutional partners.

3. *Assign "Conservation Capacity" for the action site*

First, determine the average score of the indicators within each of the three capacity success factors. The overall average score is then calculated by taking the average of these three average success factor scores. The Conservation Capacity for the site is summarized as "Very High," "High," "Medium," or "Low" according to the following grading scale for the overall average score:

>= 3.5	Very High
3.0 – 3.4	High
2.0 - 2.9	Medium
< 2.0	Low

- **Maps**

  As with the Biodiversity Health and Threat Status, Conservation Capacity is translated into four colors for the purpose displaying the Overall Capacity on maps.
  - Dark Green indicates "Very High" capacity
  - Light Green shows "High" capacity
  - Yellow means "Medium" capacity
  - Red indicates "Low" capacity

  The same base maps are used as for Biodiversity Health and Threats Status. Maps can show the conservation capacity at action sites by state, ecoregion or nation.

- **Frequency of Measure**
  Capacity is typically re-assessed every one to two years. Often conservation capacity can be enhanced over a shorter time span than it takes for complex strategies to actually abate threats.

- **Responsibility**
  State/country programs are responsible for conducting the capacity measures. Capacity is assessed jointly by the lead staff practitioner responsible for conserving the site, along with the state director or state conservation program director. Division vice presidents may also participate.

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Success Workbook* contains an automated *Capacity Worksheet* template that can be used to assess the capacity indicators. The Excel worksheet provides a computer-automated scoring system that generates Conservation Capacity for a site based on assessment of the seven capacity indicators. Moreover, the worksheets will allow a graphic presentation of the current score for each indicator.

The Excel workbook is included on the diskette that accompanied this handbook, or is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org).

An analogous "manual" *Capacity Worksheet* is provided in Appendix E, and can be copied and filled out manually to compute indicator scores and Conservation Capacity for a site.

A Note on Measures of Success, Monitoring, and Adaptive Management

The Biodiversity Health and Threat Status measures, although based on an assessment of individual conservation targets and threats, have been designed to summarize the overall, or average, level of biodiversity health and threat abatement at a site, respectively. By their summary nature, they mask the changes in viability of individual targets and the magnitude of individual threats, and therefore may not be adequate for site-specific decision-making and adaptive management. However, as should be clear from the preceding chapters of this hand-book, the target- and threat-specific information that is the basis for the summary measures also is the basis for detailed decision-making. This may include setting specific conservation goals for individual targets (see toolbox, page IV-8); identifying critical threats and precise, focused conservation strategies to abate the threats; and assessing the efficacy and success of specific strategies in achieving conservation objectives and goals, i.e., abating threats and enhancing target viability.

You and your site planning/implementation team will need to design a monitoring program that efficiently provides the appropriate information for site-specific decision-making and for the

▶ The Conservancy's *Monitoring and Adaptive Management Program* is available to provide guidance on development and implementation of monitoring programs to meet our conservation needs (contact Bob Unnasch, bunnasch@tnc.org).

▶ A more thorough discussion of monitoring and adaptive management, in the context of the Five-S framework for site conservation, is provided in the *Supplemental SCP Volume*.

organizational Measures of Conservation Success. The information needed to apply the Five-S framework should be the basis for designing such a monitoring program. Specifically, monitoring should focus on the size, condition, and landscape context of the focal conservation targets, on the severity and scope of stresses to the focal targets, and on the status of critical threats (i.e., sources of stress).